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Agricultural Research Administration
U.S. Bureau of Plant Industry, Soils,
and Agricultural Engineering

H. T. & S. Office Report No. 283

Shipping Tests with Precooled Valencia Oranges in Half-Box Size Fiber Board Cartons from Southern California to New York, August and September 1952

(In cooperation with the Ventura County Citrus Growers Committee and Sunkist Growers, Inc.)

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U. S. Department of Agriculture

and

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Introduction

It was about eighteen months ago that the present types of 1/2-box size fiber board cartons were introduced into the citrus industry of California and Arizona. Since that time the increased usage of these cartons has been almost amazing. The best available figures show that the three largest citrus shipping organizations had, during the first eight months of 1952, used over four million 1/2-box cartons, and the present indication is that there will be further expansion during the coming season when central California is expected to begin shipping in cartons.

Probably about ninety-five percent of the citrus in carton shipments have been lemons. A very large proportion of these were in the sealed (unventilated) type of carton, which has been treated with the fungistat, diphenyl. Experience has shown that lemons usually carry very satisfactorily in this sealed carton due to several well recognized factors.

The situation with oranges has appeared distinctly different from that of lemons in certain respects, which, to the present time, have limited their shipment in cartons. Strictly from the transportation viewpoint the principal limiting factor is that oranges have had to be loaded warm because no commercial precooling procedure has been available for oranges going into cartons.

Some shipping tests made by the U. S. D. A. during August and September 1951 indicated that oranges loaded warm in sealed cartons could not be adequately cooled in transit and that such procedure presented a distinct hazard. On the other hand warm oranges in ventilated cartons cooled fairly well.

In July 1952 the U.S.D.A. made a 16-car transportation test with lemons and oranges in all-carton and combination loads. Again the refrigeration performance of oranges was such as to prompt the following conclusion:

"Oranges warm loaded in cartons may be expected to remain warm to destination, regardless of the type of refrigeration service selected. The results of the tests indicate that for satisfactory and safe shipping of oranges in cartons a method of precooling before packing 1/ must be developed or adopt some type of vented carton". (H. T. & S. Office Report No. 281.)

1/ This should now read, before loading, because the results reported herewith indicate that satisfactory precooling can be done after packing.

The Ventura County Citrus Growers Committee recognizing the separate problem of shipping oranges in cartons had prepared a research project on precooling; anticipating either the development of a hydrocooling method or the adaptation of orange warehouse precooling procedures to the present need.

However, in August 1952, this Committee found itself facing a serious delay in the initiation of work on the main phase of the project and feeling the necessity for some immediate action, made arrangements with the Placentia Orange Growers Association for the use of their plant and personnel in the preparation of a series of shipments of precooled Valencia oranges in cartons. The U.S.D.A. was invited to take part in these shipments. It did so by having representatives present during the precooling and loading operations in Placentia, California and the unloading in New York City. Their principal functions were to install recording thermometers, observe fruit condition, recover equipment and special test cartons, make holding tests, and to assemble and interpret test data.

General Description of Tests

The series of tests with precooled oranges in cartons developed into a total of seven car-load shipments. In the first four shipments the oranges were precooled before packing, and in the last three, after packing. The precooling of the commercial loads was by means of air and in regular precooling rooms. A small amount of fruit in each shipment was precooled with water and brine, in which the oranges were immersed for varying periods (see Table 2).

When the commercial load was precooled before packing, the fruit was washed, graded and sized in the usual manner, placed loose in standard orange crates, and trucked into the precooling room. The packing operation was also carried on in the precooling room where they were space packed in cartons, then run through the sealer and immediately loaded. In precooling after packing the packing and precooling proceeded in the regular manner, except that the stacking in the precooling room provided more than the usual spacing. All cartons carried fiber board interliner to reinforce the top and sides. Each load consisted of 984 cartons, 930 of which formed a solid load three layers high on end and nine rows across the car. Seven of these rows had the cartons with sides facing out and two with bottoms out. The remaining 54 cartons formed a partial fourth, or deck, layer as floaters. (Note exceptions under Test No. 7) All test cars were equipped with Preco floor fans which were placed in the "on" position. Cars with and without wall flues were intentionally alternated through the tests. The icing service selected called for preiced cars, replenished, and not reiced in transit, except Test No. 2 which was reiced at Belen.

Ryan recording thermometers were wrapped in plastic bags and placed in the center of five cartons occupying the following positions in each load: Middle and top quarterlength, centerline; middle quarterlength south side; middle doorway centerline; and middle doorway south side. Fruit temperatures were also taken manually at time of loading and unloading.

Notes on Test Cars and Loads

The treatment given the few hydrocooled lots which were a part of each test shipment are shown in Table 2.

In connection with the following notes, see Table 1 and for further data see Table 3 and Charts 1 to 7.

Test
No. 1. August 19. SFRD 3748. Fan car. Wall Flues. PI-REPL-DNR.

Commercial load; air cooled before packing from 78° to 39° F. in about 90 hours. Temp. after packing and loading 42° F.

Unloaded in N. Y. 11:50 p.m. August 27 (8-1/2 days). Arrival temp. of load (Jersey City yards), 43° F. Unloading temp., 43°. Maximum average temp. (of any recorded position in the load) in transit, 44°, minimum, 41°. Approximate ice meltage to unloading 7200 pounds. Average outside temperature in transit, 77° F.

Test 1 had the third highest loading and 3rd lowest arrival temperatures. There was only 1° rise in load temp. in transit and it showed the lowest ice meltage.

"Load arrived in good order, with no damaged cartons requiring recooperage and with the floating cartons more or less random spaced over load."

Test
No. 2. August 22. SFRD 10167. Fan Car. No wall flues. PI-REPL-1 RI in transit at Belen.

Commercial load, air cooled before packing from 80° to 41° F. in about 43 hours. Temp. after packing and loading 43° F.

Unloaded in N. Y. 10:00 p.m. September 2 (10-1/2 days) Arrival temp. of load, 56°. Unloading temp. 59°. Maximum average temp. in transit 56°, minimum 43°. Approximate ice meltage to unloading 16,900 pounds. Average outside temp. in transit, 86° F.

Test 2 had the second highest loading, the highest arrival and unloading temperatures. Load temperature increased 13° in transit, but melted the largest amount of ice. It encountered the highest outside temperatures which helps to account for the poor refrigeration performance of this shipment.

"Load arrived in good order, with little shifting of the floating cartons evident. The slight deformation of some cartons was not commercially important."

Test
No. 3. September 3. SRFD 3631. Fan Car. Wall Flues. PI-REPL-DNR. Ryan at MQ SS position failed to function.

Commercial load, air cooled before packing from 80° to 38° F. in about 43 hours. Temp. after packing and loading 41° F.

Unloaded in N. Y. 7:00 p.m. September 14 (11-1/4 days). Arrival temp. of load 46°. Unloading temp. 49°. Maximum average temp. in transit 47°, and minimum 40°. Approximate ice meltage to unloading 16,000 pounds. Average outside temperature in transit, 83° F.

Test No. 3 Con't. Test 3 showed the greatest ice meltage and the load temp. increased 5° in transit.

"The load in good order."

Test No. 4. September 5. SFRD 8023. Fan Car. No wall flues. PI-REPL-DNR.

Commercial load air cooled before packing, from 81° to 40° F. in about 43 hours. Temp. after packing and loading 40° F.

Unloaded in N. Y. 8:00 p.m. September 15 (10-1/4 days). Arrival temp. of load 52° F. Unloading temperature, 55°. Maximum average temp. in transit 48° and minimum 41°. Approximate ice meltage to unloading 12,800 pounds. Average outside temp. in transit, 84° F. Fan in B-end of car failed from near Belen. This caused the average temp. in the B-end to be 5° higher than the A-end. The temperature recording equipment was in the B-end.

Test 4 had next to the lowest loading, the second highest arrival and unloading temperatures, giving it the second highest rise of load temperature in transit. It encountered the second highest outside temperatures.

"Load was in good order". "A-bunker wall had two layers of wax paper in addition to corrugated cardboard, while B-bunker wall had only corrugated cardboard. This wax paper kept the bunker packages somewhat drier".

Test No. 5. September 9. SFRD 11433. Fan Car. Wall Flues. PI-REPL-DNR.

Commercial load air cooled after packing from 77° to 38° F. in 86 hours. R. H. about 80%. Loading temp. 39° F.

Unloaded in N. Y. 1:30 a.m. Sept. 18 (8-1/2 days). Arrival temp. 39°, unloading temp. 40°. Maximum average temp. in transit 42°, and minimum 37°. Approximate ice meltage 10,000 pounds. Average outside temp. in transit, 73° F.

Test 5 had the lowest loading, arrival, and unloading temperatures. There was neither gain nor loss in load temperature in transit. It encountered the second lowest average outside temperatures.

"Load in good condition and stacked well on the pier."

Test No. 6. September 12, SFRD 9091. Fan Car. No wall flues. PI-REPL-DNR.

Commercial load air cooled after packing, from 76° to 41° F., in 48 hours. RH about 70%. Loading temp. 41° F.

Unloaded in N. Y. 7:00 p.m. September 21 (9-1/4 days). Arrival temp. 48°. Unloading temp. 52°. Maximum average temp. in transit, 47°, and

Test
No. 6
Con't. minimum, 42°. Approximate ice meltage 7600 pounds. Average outside temp. in transit 74° F.

Test 6 showed a good refrigeration performance for a non-flu car. The load temperature rise from 41° to 48° in transit and about four more degrees while standing in the Jersey City yards.

"Cartons were free from moisture and rigid."

Test
No. 7. September 19. SFRD 3802. Fan car. Wall flues. PI-REPL-DNR.

Commercial load air cooled after packing from 70° to 39° F. in 48 hours. Loading temp. 45°.

Unloaded in N. Y. 11:00 p.m. September 29 (10-1/2 days). Arrival temp. 42°. Unloading temp. 44°. Maximum average temp. in transit 42° and minimum 41°. Approximate ice meltage 11,300 pounds. Average outside temp. in transit, 69° F.

Test 7 had the highest loading, the second lowest arrival and the third lowest unloading temperatures. The load temperature was reduced 3° in transit - the only test in which it was reduced. It encountered the lowest average outside temperature (17° lower than the average for test 2, which encountered the highest).

"Load in fair order on arrival with some tilting of packages noted. The 'on end' packages came through somewhat better than the flat load packages". This load was of a slightly different pattern than the six previous shipments. Also the corrugated liners in the cartons carried at each end a 2/16 x 1-5/8 inch wooden strip which when in place extended from bottom to top of carton at each corner. Although the cartons of the inner rows showed slight to moderate moisture they generally held their shape.

Condition of Fruit at Destination

Inspections were made of test fruit near the time of arrival and after a holding period of two weeks at 45° F. plus one week at 70° F. The fruit used in the holding test consisted mostly of two cartons each of air, brine and water precooled lots. These were allowed to remain sealed during the holding period. This probably accounts for the rather excessive rate of darkening of buttons recorded. The presence of diphenyl and some accumulation of respirational by-products in the cartons should be taken into consideration.

The very abbreviated data of the inspections are presented in tables 4 and 5.

Summary

The present series of shipments consisted of seven car-loads of precooled Valencia oranges in sealed cartons. The precooling was performed before loading in the car, either before or after packing. The commercial loads were precooled

by means of air in the regular precooling rooms, but a few experimental lots were hydrocooled with water and brine. The temperature of the oranges before precooling ranged from 72° to 82° F. and cooled to 36°-47° F. by hydrocooling and to 39°-41° F. by air.

Five of the seven shipments carried to destination with relatively small rise or lowering of load temperature and were considered to have shown very satisfactory refrigeration in transit. Two shipments in non-wall-flue equipped cars which also encountered high average outside temperatures, showed undesirable load temperature rises into the upper fifties. On the whole the results of these tests indicate that precooled oranges in sealed cartons present no especial refrigeration in transit problem.

Also the experience of these tests and others show clearly a refrigeration advantage of cars equipped with both fans and wall flues for citrus in sealed cartons.

However favorable the above findings may be, they do not provide any solution to the problem for those packing houses not already equipped with standard precoolers, which probably means about seventy-five percent of the industry. Therefore, for oranges there remains the considerable task of developing adequate precooling before loading methods or the use of ventilated cartons.

Acknowledgments

Arrangements for these shipping tests were by the Ventura County Citrus Growers Committee through Roy J. Smith, University of California and J. R. MacRill, Sunkist Growers, Inc., and made possible by the excellent cooperation of S. B. McMurray of the Placentia Orange Growers Association.

Among others taking active part in the preparation of the tests were:

Vincent Gessel, Transcontinental Pre-cooling Company.
Robert Craighead and Lee Smith, International Paper Company.
Jim Palmer and Dana Newkirk, Sunkist Growers.
Harlan Barber, U. S. Department of Agriculture.

TABLE NO. 1 The seven shipping tests arrayed in the order of increasing rise of average load temperatures in transit (= Column 4)

Column 1	2	3	4	5	6	7	8	9
Test No.	FLUES, With or Without	AV. TEMP. in transit (8½ days)	LOAD TEMP. Gain or Loss in Transit	AVERAGE Unloading Temp. by Ryans	AVERAGE Unloading Temp. by Manual	ICE Melted To unloading (100 lb. Units)	DAYS Standing in J.C. Yards	APPROX. Outside Temp. in Transit
7	+	45°-42°	-3°	44°	45°	113	2	69°
5	+	39°-39°	0°	42°	43°	100	0	73°
1	+	42°-43°	+1°	43°	43°	72	0	77°
3	+	41°-46°	+5°	49°	50°	160 1/	3	83°
6	-	41°-48°	+7°	52°	51°	76	1	74°
4	-	40°-52°	+12°	55°	55°	128	2	84°
2	-	43°-56°	+13°	59°	59°	169 2/	3	86°

1/ Iced day of arrival with 6000 lbs. of which about 3200 lbs. were melted in 2½ days standing after reicing.

2/ Iced 55 hours after arrival, with 6000 lbs. of which about 3200 lbs. were melted during the remaining 18 hours to unloading.

TABLE No. 2. HYDROCOOLING TREATMENT

Fruit Cooled In Brine

Test No.	Duration in brine	Temp. of brine before test	Temp. of brine during test	Beaume Density	Fruit Temp. before test	Fruit Temp. after test	Rinsed in water
1	36 min.	26 deg.	32 deg.	3.	77 deg.	47 deg.	39 deg.
						41 "1/	
2	43 "	27 "	32 "	6.3	73 "	46 "	39 "
	35 "1/		30 "1/			44 "	
3	44 "	30 "	35 "	6.	72 "	47 "	34 "
	36 "		30 "			46 "	
4	45 "	27 "	37 "	6.3	82 "	47 "	65 "
	51 "		31 "			36 "	
5	57 "	27 "	35 "	6.3	77 "	39 "	65 "
	44 "		29 "			43 "	
6	48 "	26 "	31 "	6.3	77 "	47 "	65 "
	40 "		29 "			43 "	
7	42 "	27 "	31 "	6.3	73 "	45 "	65 "

Fruit Cooled In Water

Test No.	Duration in water	Temperature of water	Fruit Temp. before test	Fruit Temp. after test	No. Boxes 220 size
1	52 min.	36 deg.	77 deg.	46 deg.	6
2	53 "	35 "	76 "	40 "	3
3	50 "	34 "	72 "	43-46 "	3
	58 "1/	33 "1/			
4	68 "	37 "	82 "	45-47 "	3
	54 "	35 "			
5	68 "	39 "	77 "	43-45 "	3
	53 "	32 "			
6	60 "	36 "	77 "	42-45 "	3
	52 "	32 "			
7	61 "	35 "	73 "	44-48 "	3

1/ Where two figures are given it indicates the temperatures variation in the treating tanks used for a single lot.

Ryan Thermometer Transit Temperatures

Table No. 3 — Precooled before Packing into Fiber Cartons

Shipment No. 1 — Fans on - Adjustable wall flues open

August	19 1/	20	21	22	23	24	25	26	27	Average of nine days
								(Ryan failed)		
TQ CL	45	46	44	43	43	43	43	-	-	44
MQ CL	42	42	42	42	43	43	43	44	44	43
MQ SS	42	42	42	42	42	41	41	42	42	42
MD CL	41	41	42	42	42	42	42	42	42	42
MD SS	43	44	44	44	43	43	43	42	42	43

Shipment No. 2 — Fans on - No wall flues

August	22 1/	23	24	25	26	27	28	29	30	31	Sept. 1	Sept. 2
TQ CL	46	48	48	47	48	51	43	54	56	50	58	59	60
MQ CL	39	39	39	40	41	43	45	47	49	43	50	52	53
MQ SS	43	46	48	50	52	54	56	57	59	52	61	62	63
MD CL	42	43	43	44	45	46	47	49	51	46	52	53	55
MD SS	46	49	51	53	54	57	59	59	60	54	61	63	63

Shipment No. 3 — Fans on - Adjustable wall flues open

September	3 1/	4	5	6	7	8	9	10	11	12	13	14
TQ CL	46	48	44	43	43	44	46	49	48	46	54	58	59
MQ CL	40	39	39	40	41	41	41	42	43	42	44	45	46
MQ SS	59	53	Ryans failed to function										
MD CL	40	41	41	42	42	42	42	42	43	42	44	45	46
MD SS	43	45	45	45	46	46	47	47	48	47	50	52	54

Shipment No. 4 — Fans on - No wall flues

August	5 1/	6	7	8	9	10	11	12	13	14	15
TQ CL	45	47	44	43	44	47	49	51	52	47	55	57
MQ CL	40	40	40	41	41	43	44	45	47	42	49	51
MQ SS	39	41	43	44	44	46	49	52	54	46	56	58
MD CL	38	38	38	39	39	40	41	43	45	40	47	49
MD SS	40	43	45	46	47	49	51	53	53	48	52	59

1/ Loading day

Ryan Thermometer Transit Temperatures

Table No. 3
Con't.

Precooled in Fiber Cartons After Packing

Shipment No. 5 Fans on - with wall flues

September	1/ 9	10	11	12	13	14	15	16	17	Average of nine days	18
TQ CL	38	42	38	37	39	40	40	40	40	39	40
MQ CL	38	37	37	38	39	38	39	-	-	38	-
MQ SS	39	38	38	37	38	39	39	39	40	39	40
MD CL	38	37	36	36	36	36	37	37	37	37	37
MD SS	39	39	39	39	39	39	40	40	40	39	40

Shipment No. 6 Fans on - no wall flues.

September	1/ 12	13	14	15	16	17	18	19	20		21
TQ CL	42	43	44	44	44	46	46	47	47	44	50
MQ CL	38	38	38	39	40	41	42	43	45	41	46
MQ SS	41	41	43	44	47	49	50	-	-	45	-
MD CL	42	41	41	41	41	43	44	45	47	43	47
MD SS	41	42	43	44	44	45	46	47	48	45	49

Shipment No. 7 Fans on - Adjustable wall flues open

September	1/ 19	20	21	22	23	24	25	26	27		28	29
TQ CL	46	48	46	43	41	41	42	43	43	44	43	46
MQ CL	44	43	43	43	43	43	43	43	43	43	43	44
MQ SS	42	42	41	41	40	41	41	41	41	41	42	43
MD CL	44	45	44	43	43	42	42	41	41	43	41	41
MD SS	45	45	45	44	43	43	43	44	43	44	43	45

1/ Loading day

TABLE No. 4 Arrival Inspections of Test Fruit (Consensed from Official Reports) 1/

Test Shipment No.	Precooled with	Decay %	Water or Brine soaked Injury %	Buttons	Remarks on Fruit Conditions
1	Air	0	0	Green	Firm and fresh - no appreciable difference between the three lots.
	Brine	0	0	Green	
	Water	0	0	Green	
2	Air	1.8	0	Green	Generally firm
	Brine	7.2	4.5	Green	Generally firm
	Water	0	5.4	Green	Generally firm
3	Air	0	0	Green	Firm and fresh appearing
	Brine	0.9	0	Green	Firm and fresh
	Water	0.9	0	Green	Firm and fresh to 2% soft. (Comments of trade classed this fruit as very good)
4	Air	0	0	Green	Firm and fresh
	Brine	0	5	Green	Firm and fresh
	Water	1.4	0.9	Green	Firm and fresh
5	Air	0	0	Green	Generally firm and fresh. (Firmer and fresher than hydrocooled)
	Brine	2.7	2.7	Green	Pliable to 10% soft.
	Water	1.8	1.8	Green	Mostly pliable, 5% soft.
6	Air	0	0	Green	Generally firm and fresh a few soft.
	Brine	1.8	1.8	Green 3% off	Mostly firm to about 6% soft.
	Water	3.2	3.2	Green 3% off	Mostly firm to about 5% soft.
7	Air	0.9	0	Green	Mostly firm, a few soft.
	Brine	0	2.7	Green	Mostly firm to about 4% soft.
	Water	0.9	0.9	Green	Mostly firm to 4% soft. (Hydrocooled fruit similar to air cooled fruit)

1/ Arrival inspections were in charge of H. W. Hruschka, U.S.D.A. and Jim Scanlon, Sunkist Growers but assisted by others at times, e.g. Messrs. Bunda and Gerhart, Sunkist; Kowalski and Phillipps, International Paper Company; Wallenburg and Schoo, Longview Fiber Company.

ABLE No. 5. Inspections of Test Fruit After Two Weeks at 45° Plus One Week at 70°F.
(Condensed from Official Reports)

Test Shipment No.	Precooled by means of	No. of Ctns.	Average Total Decay %	Average Distinguished as Water or Brine soaked Injury %	Average Pitting and aging %	Buttons	Remarks on General Condition of Fruit
1	Air	2	2.7	0	3.6	Mostly black and moldy	Mostly firm to 5% soft.
	Brine	1	2.7	2.7	0	Mostly green, 7% black & moldy	Mostly firm to 4% soft.
	Water	4	9.3	5.5	2	Mostly green to 17% black and moldy	Mostly firm to 4% soft.
2	Air	2	1.8	0	2.3	Mostly black	Firm
	Brine	2	2.7	0.9	0	Mostly black	Mostly firm to 8% soft.
	Water	2	7.7	3.2	1.5	Mostly green	Mostly firm to pliable to 3% soft.
3	Air	2	3.6	0	1.5	Dark green to considerable black 23% moldy	Firm
	Brine	2	9.0	0	1.4	Dark green to considerable black 23% moldy	Mostly firm to a few soft.
	Water	1	3.6	0	3.0	Dark green to about 40% black; 25% moldy	Mostly firm to 5% soft
4	Air	2	2.3	0.9	4.0	Dark Green to considerable black, 22% moldy	Firm. Considerable difference in appearance. Aircooled - bright, and had sales appeal.
	Brine	2	16.7	7.7	7.0	Dried and black to about 30% moldy	Firm but dull appearing, mold spores.
	Water	1	27.3	6.4	12.0	Gen. Black and moldy	Firm dull and unattractive - mold spores.
5	Air	2	1.4	0	10.0	Mostly green to considerable black 15% moldy	Firm
	Brine	2	13.6	9.1	10.0	Mostly green to considerable black 13% moldy	Mostly pliable to 6% soft.
	Water	1	10.0	5.5	18.0	Mostly green to Con.Blk.	Pliable to about 12% soft.

TABLE No. 5 Inspections of Test Fruit After Two Weeks at 45° Plus One Week at 70°F.
Con't. (Condensed from Official Reports)

Test Shipment No.	Precooled by means of	No. of Ctns.	Average Total Decay %	Distinguished as Water or Brine soaked Injury %	Pitting and aging %	Buttons	Remarks on General Condition of the Fruit
6	Air	2	2.7	0	0	Mostly green to 25% black a few moldy	Mostly firm to considerable pliable - a few soft
	Brine	2	8.0	0	4.0	Mostly green to 40% black considerable moldy	Mostly pliable to some soft - coated with mold spores
	Water	1	10.0	0	0	Mostly dry and black, 15% moldy	Pliable to some soft. Unattractive due to coating of mold spores.
7	Air	1	1.4	0	5.0	Mostly green to considerable black	Firm
	Brine	2	10.9	6.0	2.7	Mostly green to considerable black.	Mostly pliable to some soft.
	Water	2	10.9	7.3	2.7	Mostly black and dry	Mostly pliable to some soft and creased

Inspections after holding were in charge of H. W. Hruschka, U. S. D. A., and J. A. Scanlon, Sunkist Growers.

RYAN TEMPERATURES

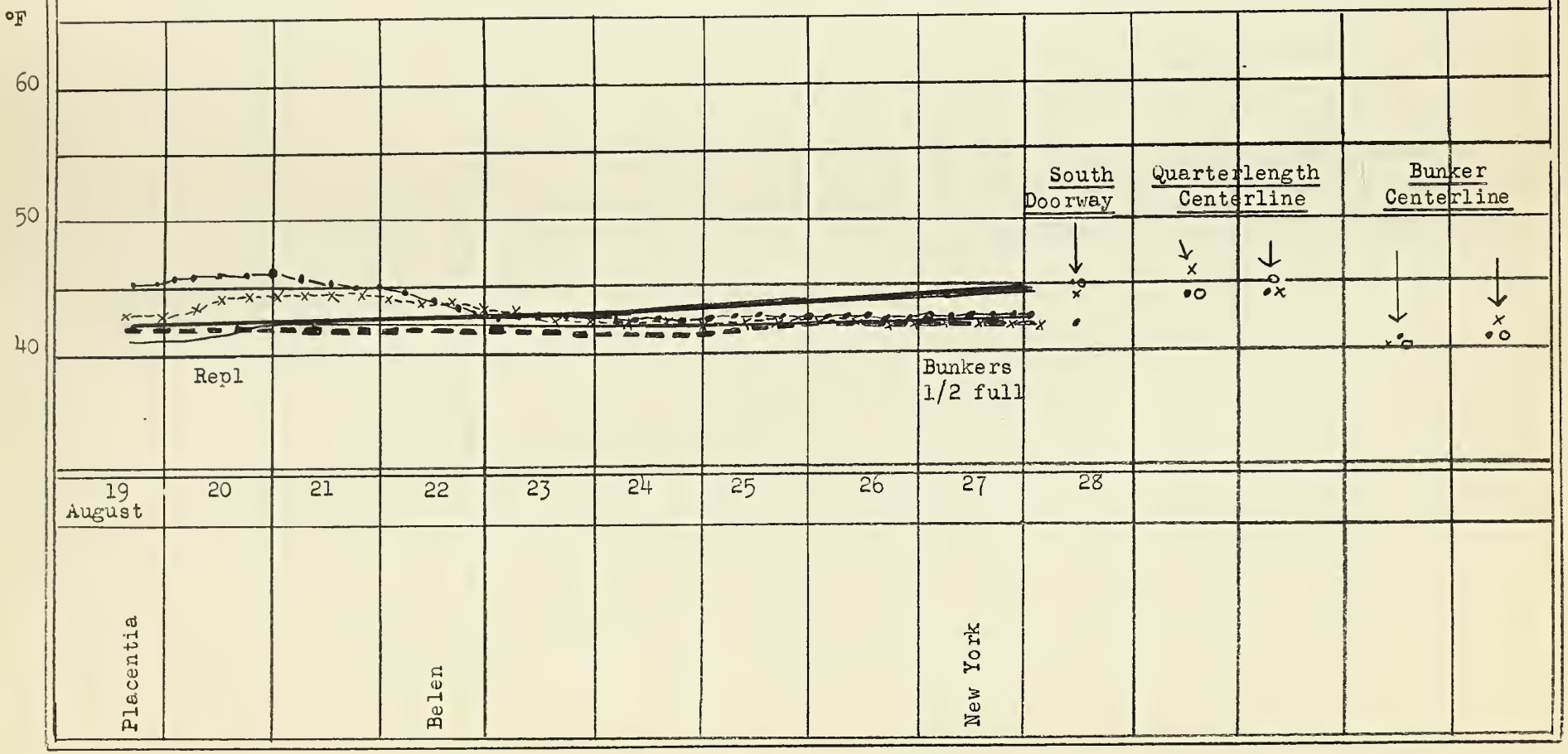
TQ CL
MQ CL
MQ SS
MD CL
MD SS

MANUAL TEMPERATURES
AT DESTINATION

Top
Middle
Bottom

CHART I

Shipment #1
Full Bunker. PI-REPL-DNR
Fans on. Adjustable flues open.
Valencia oranges precooled before packing into fiber cartons.



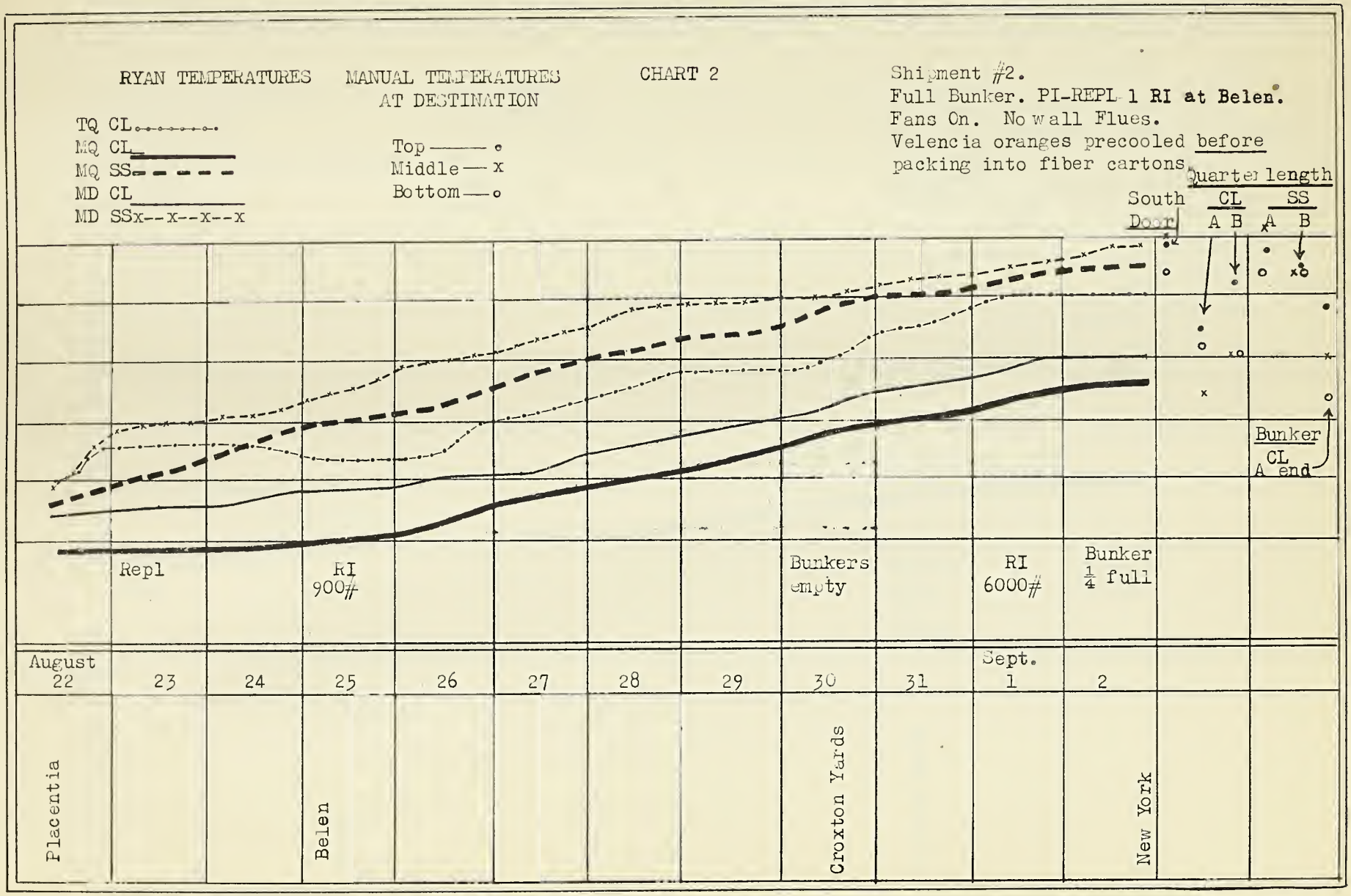

RYAN TEMPERATURES
MANUAL TEMPERATURES AT DESTINATION
CHART 2
TQ CL
MQ CL
MQ SS
MD CL
MD SS
Top
Middle
Bottom
Shipment #2.
Full Bunker. PI-REPL-1 RI at Belen.
Fans On. No wall Flues.
Velencia oranges precooled before packing into fiber cartons.
Quarter length
South Door
CL A B
SS A B
Bunker CL A end
°F
60
50
40
Repl
RI 900#
Bunkers empty
RI 6000#
Bunker ¼ full
August 22 23 24 25 26 27 28 29 30 31
Sept. 1 2
Placentia
Belen
Croxton Yards
New York

CHART 3

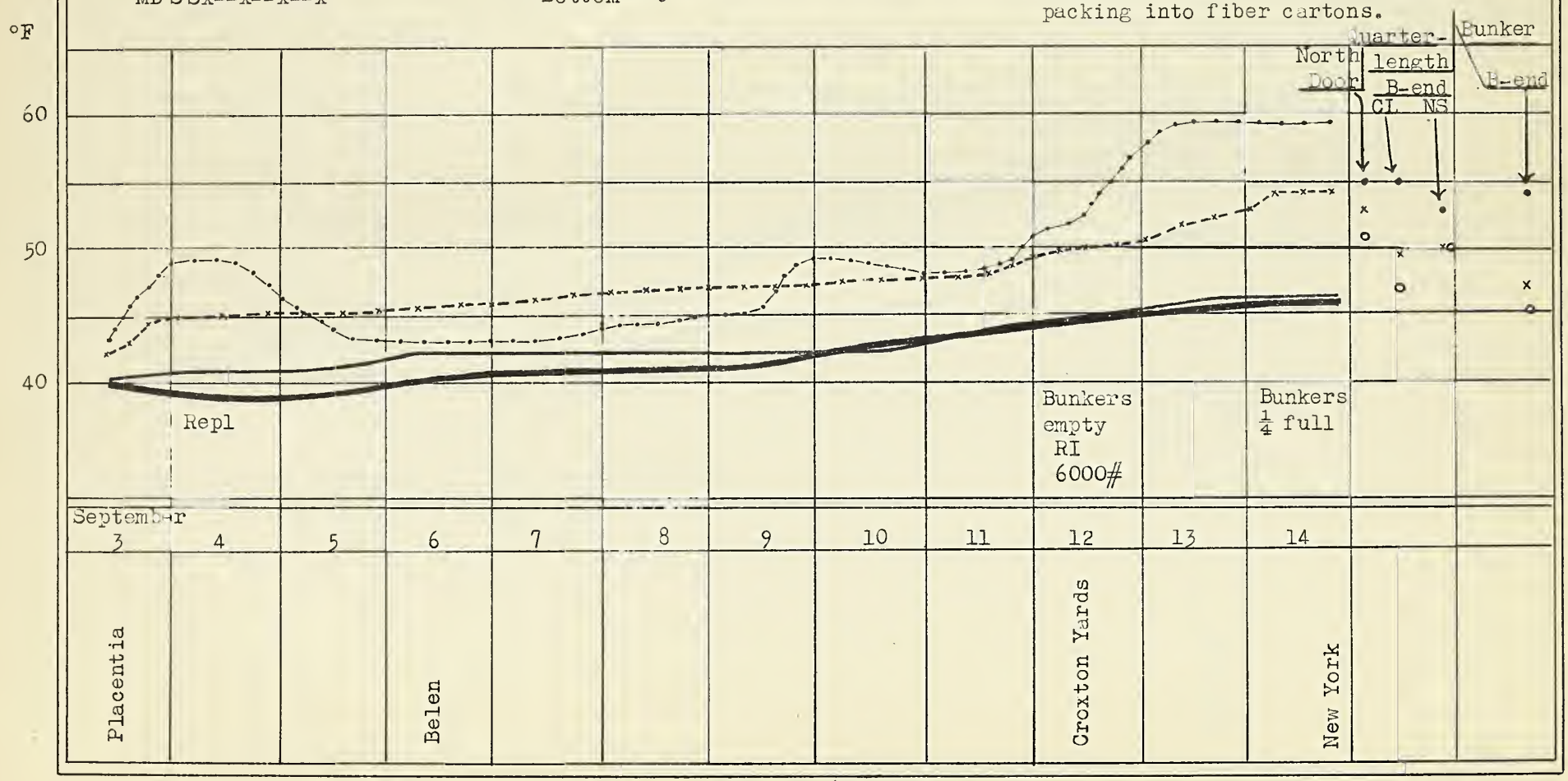
RYAN TEMPERATURES

TQ CL
MQ CL
MQ SS Ryan failed to function
MD CL
MD SSx--x--x--x

MANUAL TEMPS. AT DESTINATION

Top———
Middle—x
Bottom—o

Shipment #3.
Full Bunker. PI-REPL-DNR
Fans On. Adjustable flues open (except right side flue of A end closed by vibration.
Valencia oranges precooled before packing into fiber cartons.



RYAN TEMPERATURES

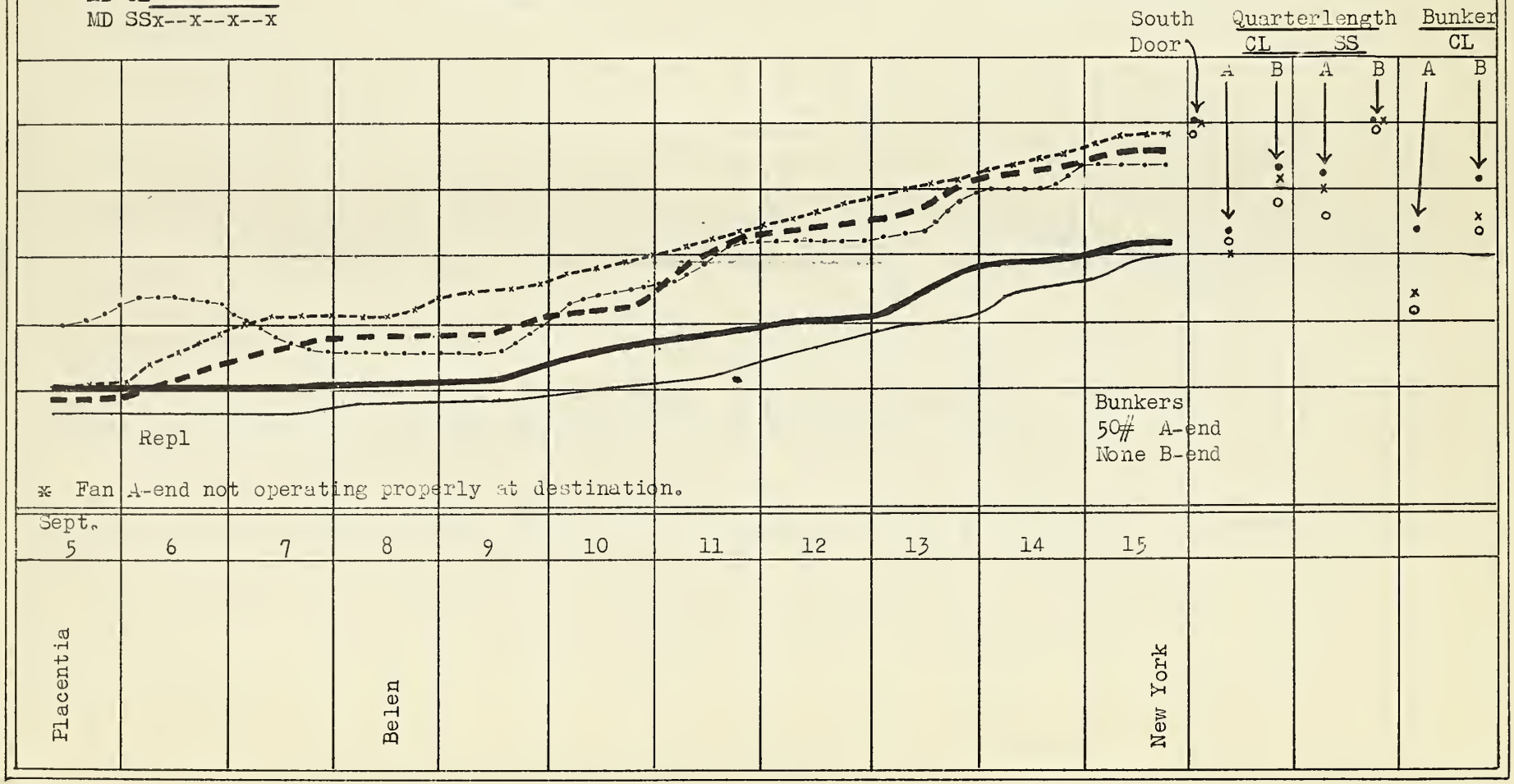
TQ CL
MQ CL
MQ SS
MD CL
MD SS

MANUAL TEMPERATURES AT DESTINATION

Top
Middle
Bottom

CHART 4

Shipment #4
Full Bunker. PI-REPL-DNR
Fans On.* No wall flues.
Valencia oranges precooled before packing into fiber cartons.



RYAN TEMPERATURES

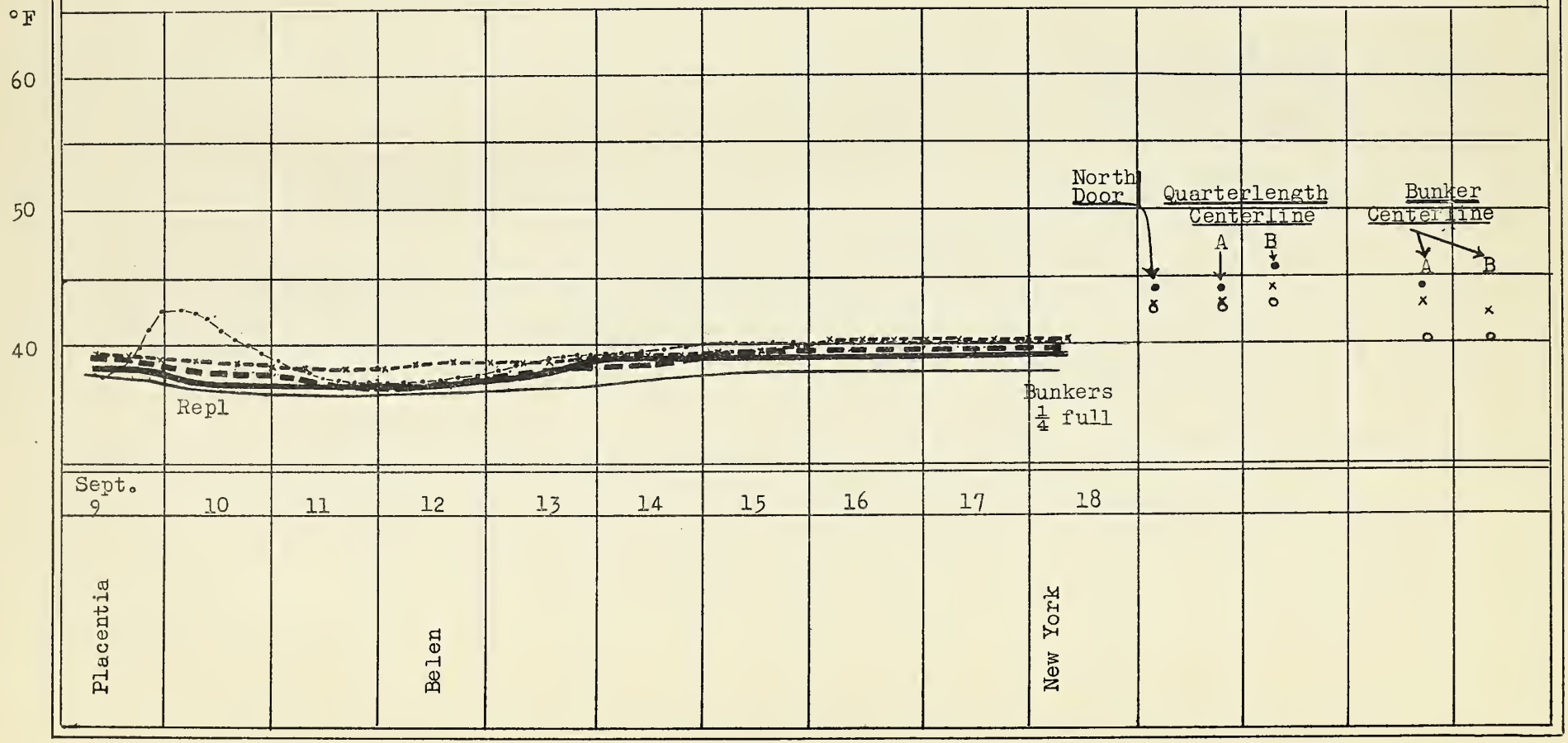
TQ CL
MQ CL
MQ SS
MD CL
MD SS

MANUAL TEMPERATURES AT DESTINATION

Top
Middle
Bottom

CHART 5

Shipment #5.
Full Bunkers. PI-REPL-DNR
Fans On. With wall flues.
Valencia oranges precooled in fiber cartons after packing.



RYAN TEMPERATURES

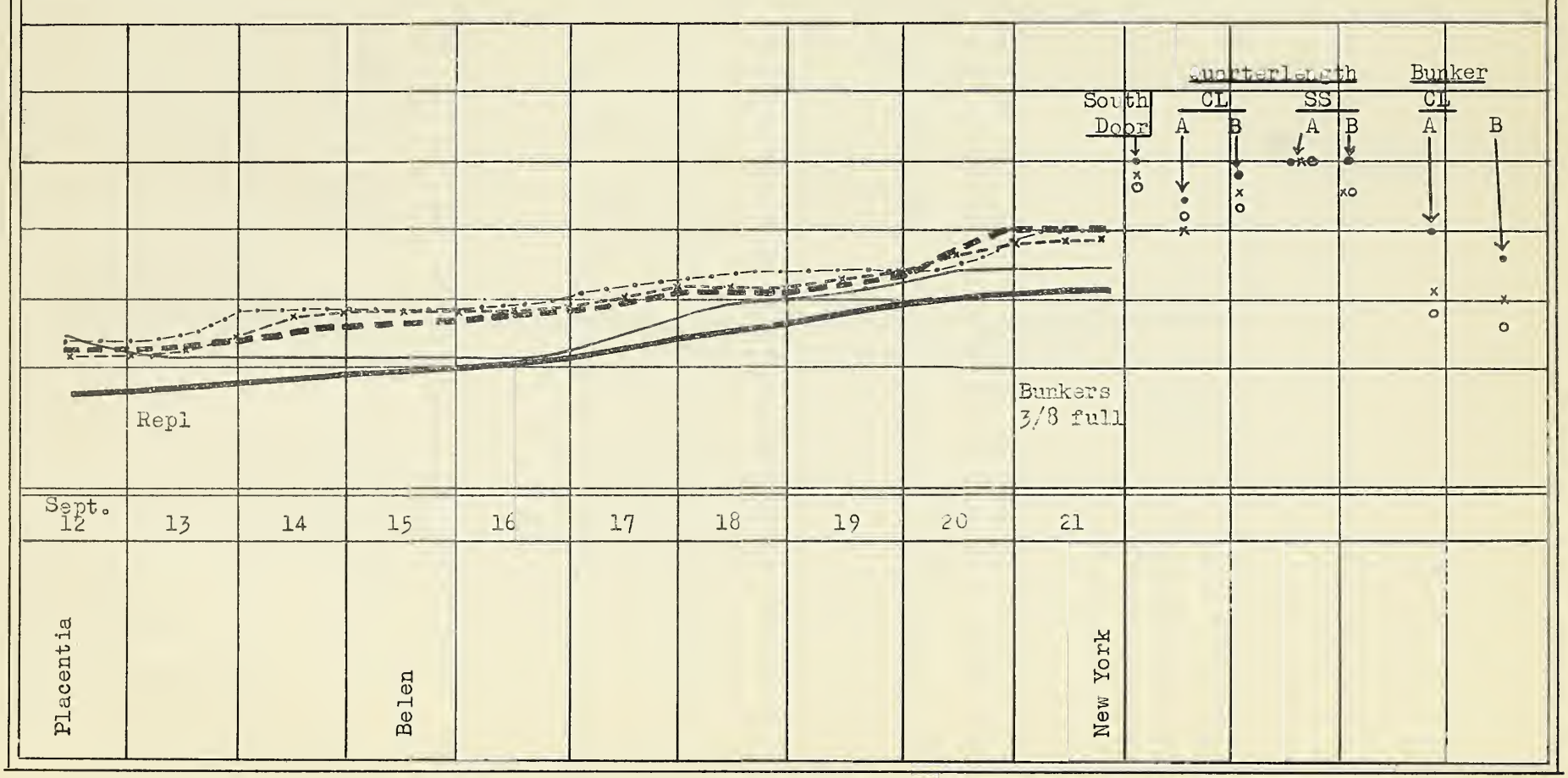
TQ CL
MQ CL
MQ SS
MD CL
MD SS

MANUAL TEMPERATURES AT DESTINATION

Top
Middle
Bottom

CHART 6

Shipment #6.
Full Bunker. PI-REPL-DNR
Fans On. No wall flues.
Valencia oranges precooled in fiber cartons after packing.

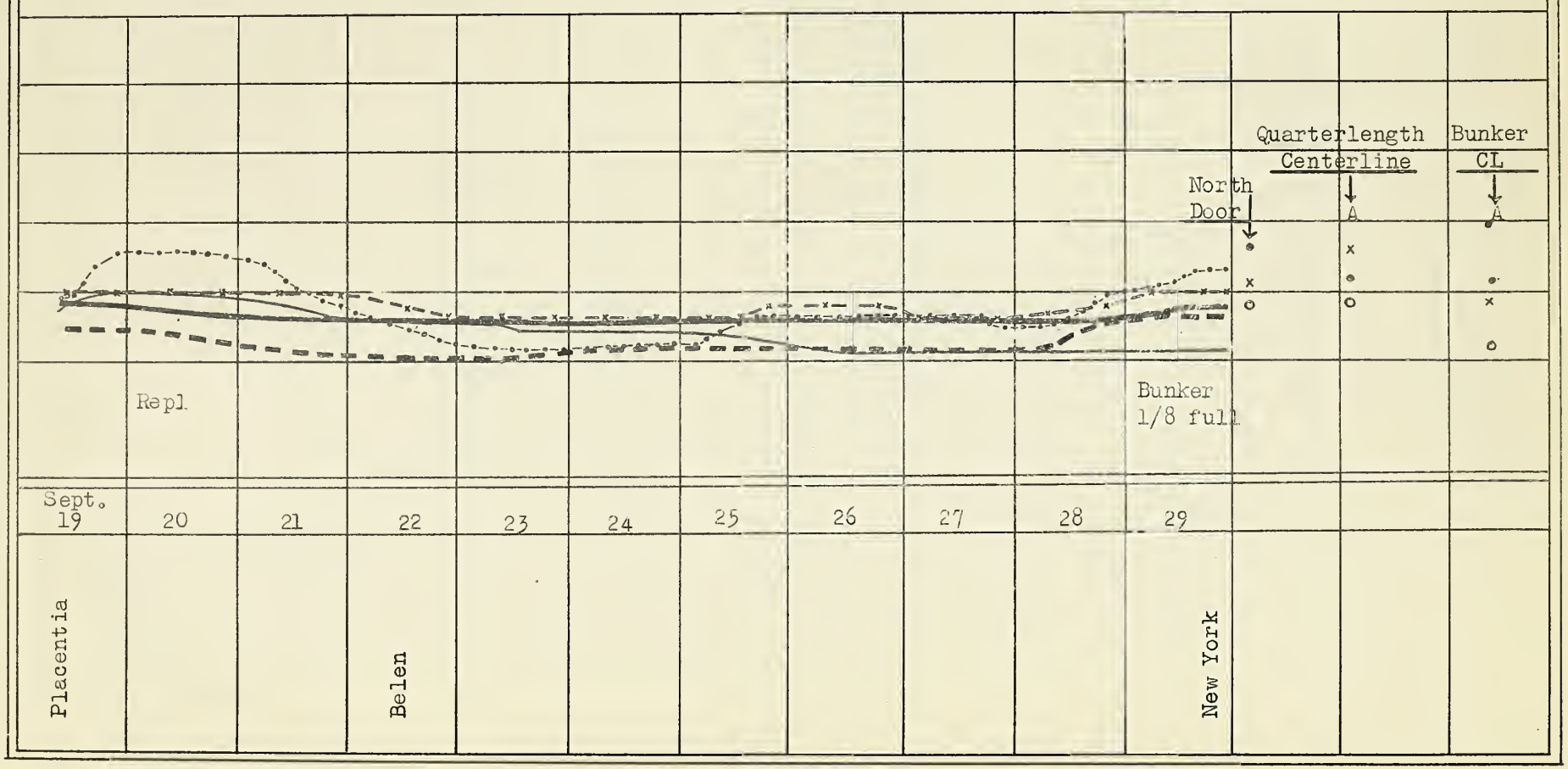


RYAN TEMPERATURES

TQ CL
MQ CL
MQ SS
MD CL
MD SS

MANUAL TEMPS. AT DESTINATION

Top
Middle
Bottom

CHART 7

Shipment #7.
Full Bunker. PI-REPL-DNR
Fans On. Adjustable wall flues open.
Flue on southside B-end vibrated to closed position.
Valencia oranges precooled in fiber cartons after packing.